US Army Corps of Engineers®
Engineer Research and Development Center

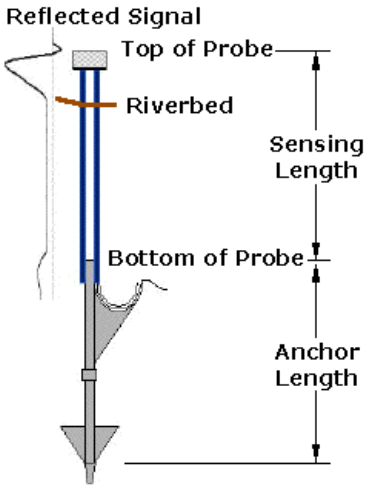
Bridge Scour Detection and Monitoring with Time Domain Reflectometry

Description

A time domain reflectometry (TDR)-based system has been developed for civil engineers to use for continuous real-time, dynamic detection and measurement of bridge scour, a hazardous condition that occurs during times of rapid river flow and especially under ice conditions. It is caused by currents transporting sediments away from bridge piers, buried utilities, and similar structures.

Capabilities

The TDR system developed at the U.S. Army Cold Regions Research and Engineering Laboratory employs a number of inexpensive, vertically oriented sensors that are securely anchored into sediments below the maximum expected depth of scour. It can easily be installed on new construction and retrofitted to existing structures. The TDR system can detect changes in river sediment depths of less than 2.5 cm (1 in.).



Supporting Technology

The TDR bridge scour detection and monitoring system consists of a Campbell CR10X data acquisition system with a TDR100 interface and sensors that are manufactured at CRREL.

CRREL's skilled staff offers on-site consultation and program development, implementation, and design of customized TDR-based bridge scour detection and monitoring systems for municipal and state departments of transportation.

Benefits

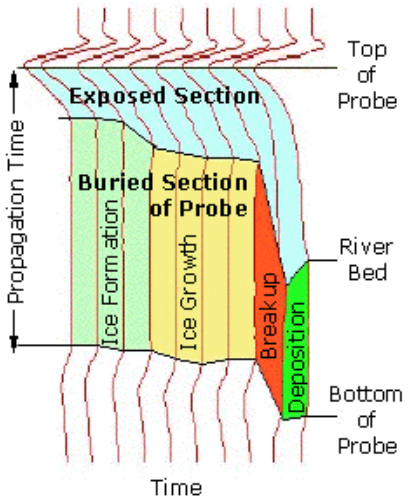
Because bridge scour can cause millions of dollars of infrastructure damage, repairs and maintenance, and potential loss of life, the TDR-based bridge scour detection system provides an economical way of tracking the erosion of foundation materials below pier footings, which may leave a bridge unsupported and in danger of collapse.

This monitoring and detection system

- Is effective even with high energy flow.
- Is effective under ice cover and in debris-infested water.
- Allows unattended automatic operation.
- Provides all-weather, day-and-night operation.
- Provides high resolution of scour depth.
- Supplies real-time, dynamic data.
- Resets automatically, enabling measurement of multiple erosion/deposition events.

Success Story

A typical application of the TDR bridge scour detection and monitoring system was the Corps of Engineers Omaha District's study of the impact of ice cover formation on riverbed erosion in the Missouri River. The study showed that the river bed changed each winter. During cover formation, the bed would be scoured to maintain flow conveyance equilibrium. Once in balance, the elevation remained relatively stable as the ice thickened. Then, just before breakup, scour resumed as water discharge increased. After breakup, extensive soil erosion caused deposition downstream in municipal water intakes. To reestablish equilibrium, the river embankments eroded to fill the holes caused by the scour.



A waterfall plot of signals from the TDR monitoring system documents changes in bed elevation with time as a function of ice processes.

Point of Contact

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